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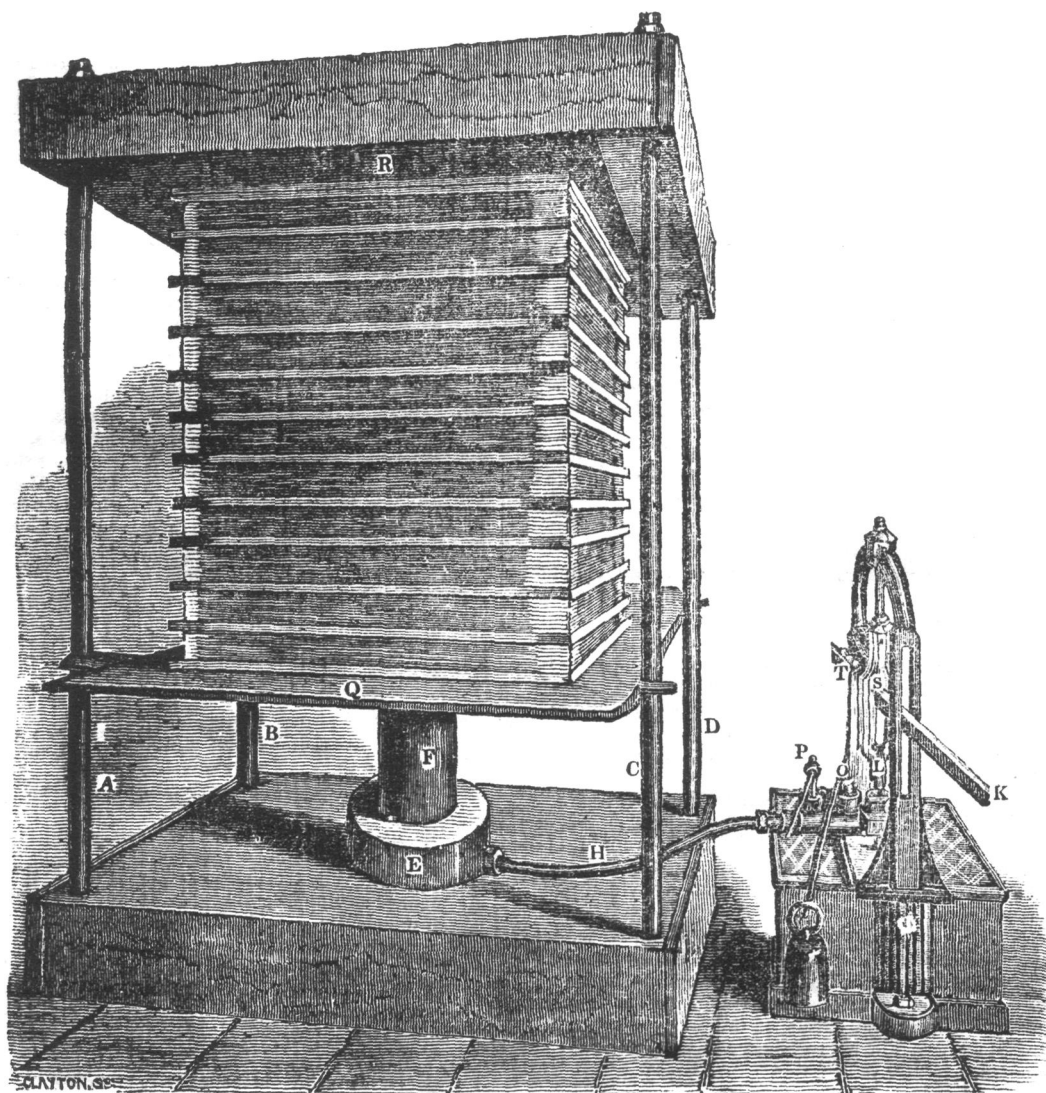
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level in the bellows that it does in the tube. If the tube be filled to the top A, then, of course, the pressure produced by that column would balance a column DG of the same height, if the vessel were continued; and hence the upward pressure on the interior surface of the upper board is such as would support any weight not greater than the weight of the water in the column DEGF."

Now all this is very correct—but then comes the demonstration as to the hydrostatic press; and here we find him at fault, as we venture to affirm, no one, either from

the drawing of the press, or the description given in the little book, could form any thing like a correct idea of how it is worked. Considering the Hydrostatic press one of the most curious though simple machines which this "great age of invention" has produced, we annex a description and drawing of one of those at present used in our own office, which, by the power of one or two men at the pump handle, brings a pressure equal to three hundred tons weight on the paper pressed.

HYDROSTATIC PRESS.



ABCD are four strong iron pillars, which passing through two square plates of cast metal, the head and base, and fastened by transverse pins, form a frame of great strength. Inside the frame is fixed a piece of hollow metal E, forming a cylinder of considerable thickness, into which falls F, a ram or plug, made perfectly air and water tight, by means of a leather ring. Connected to the cylinder is a small iron pipe, H, which it will be perceived is also connected to a force pump, worked in the usual way by the lever KS, and supplied with water from the small cistern underneath, and of which L is the piston. There are two valves, the one placed in the connecting pipe of the pump, and the other under the pump. O is a safety valve. P is a small aperture, opened by a screw valve, and by which the water is let back into the cistern when emptying the press. When, by the working of the pump, the cavity in cylinder E is filled with water, the pressure on the surface will, of course, act upon the

stem of the ram or plug, F, and forcing upwards, will consequently give the pressure to any substance placed between the plates Q and R; and the ring inside the cylinder, being formed of a piece of leather doubled together, the water when forced up between the cylinder and ram, presses the leather against both, and thus renders the tube air and water tight.

"To estimate this pressure, we must keep in mind that a fluid diffuses a pressure equally in all directions; by consequence, whatever pressure the piston, L, conveys to a fluid particle below it, that very same pressure will be conveyed to every particle below the stem F; and hence that the pressure of the water upon F will be so much greater than the pressure of the piston L upon the water, as the surface of F, upon which the water acts is greater than the surface of the water upon which the piston L acts. For example, if the surface of F were ten times the surface of the piston L, then a downward

pressure of one pound by the piston would produce an upward pressure upon the plug of ten pounds. If the surface of F were one hundred times that of the piston, then the upward pressure upon the plug, by the same downward pressure as before, would be one hundred pounds, and so on.

"Q. Might not a very considerable pressure be produced by means of the lever KS?"

"A. Supposing, for the sake of illustration, that the force at L is 50 lbs., that the arm K is six times ST, and that the surface of the plug F is 100 times the surface of the piston L, then the whole upward pressure upon F will be 30,000 lbs. or very nearly 13½ tons.

"Q. How do you proceed in such a calculation?"

"A. As follows:—Since ST is the 1-6th part of K, a pressure of 50 lbs. at K will produce a pressure of $50 \times 6 = 300$ lbs. at T, or on the piston L. Again, as the surface of F upon which the water acts is 100 times the surface of that upon which the piston acts, a pressure of 300 lbs. by KS will become a pressure of $300 \times 100 = 30,000$ lbs. upon the plug F.

"Q. How do you compare the surfaces of action of the piston and plug?"

"A. These are to one another as the squares of their diameters. So that if the diameters be as 1 : 10, the surfaces will be as $1 \times 1 : 10 \times 10$, or as 1 : 100.

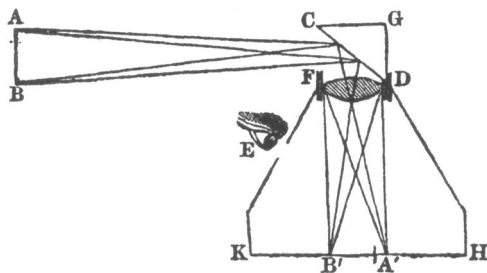
"If the diameters were as 1 : 20, then the surfaces brought into action would be as $1 \times 1 : 20 \times 20$, or as 1 : 400. In this case, if the lever, as before, produce a pressure on L of 300 lbs. this will excite an upward pressure on the plug F of 300×400 , or 120,000 lbs., or 54 tons nearly.

"Thus you see that the mechanical efficacy of the hydrostatic press is enormous, and indeed that the only consideration which sets limits to its power, is the requisite strength of the materials which form it.

"CAMERA OBSCURA.

"Q. From what arrangements does the camera obscura take its name?"

"A. The camera obscura, or darkened chamber, is so called from the circumstance of all stray light being excluded from the inside of it; one form of its construction is as follows:—FDHK is a wooden box stained black in the inside, CGDF is a sliding piece, having a sloping mir-



ror CD, and a double convex lens FD, which may, with the mirror GD, be slid up or down, so as to accommodate the lens to near and distant objects. When the rays proceeding from any object, as AB, fall upon the mirror, they are reflected upon the lens FD, as shown in the diagram, and by this means, under proper adjustments, brought to corresponding foci in the bottom of the box as at A'B'; a sheet of paper being placed there, the picture will be depicted upon it, and may be seen by an eye looking through an opening at E.

"Q. Does the person who is to observe the picture sit with his back to the object?"

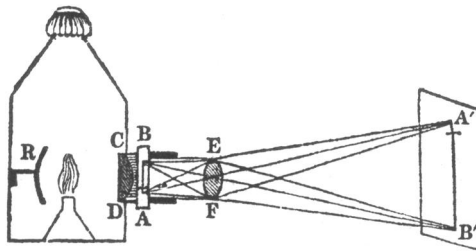
"A. He does; and if another opening be made in the side of the box, so as to admit the hand, the picture may be readily delineated. The mirror CD is hinged at D, so that its inclination or slope may be changed at pleasure, in order to suit the position of the object. The camera obscura is an elegant instrument, and when exposed to living figures, becomes exceeding amusing, these being represented in their true colours, and given in all their varied attitudes and fantastic motions.

"MAGIC LANTERN.

"Q. Whence the peculiar designation of the optical instrument called the magic lantern?"

"A. It is absurdly so named, from the remarkable representations which it gives, these being very commonly of a grotesque and amusing description. The instrument is as follows:—

"A lamp having a concave reflector behind it, is placed nearly in the focus of a plano-convex lens CD, which



will, in conformity with the principles of lenses, transmit the light which passes through it nearly in parallel directions upon any object, as AB, placed on the other side of it. The object AB being thus highly illuminated, rays will of course proceed from every point of it, as AB, and fall upon the lens EF, which will unite them in their corresponding foci, as at A'B'; an enlarged picture of any small transparency will thus be formed, and may be received upon a screen or wall at the proper distance.

"The tube containing the lens EF is made to slide out and in, so as to accommodate in some measure the distance of the foci to the distance of the screen. The little transparency, painted on a piece of glass, surrounded by a frame, slides into a niche, as represented in the figure, and, care being taken to invert the transparency, an erect picture of it is consequently formed.

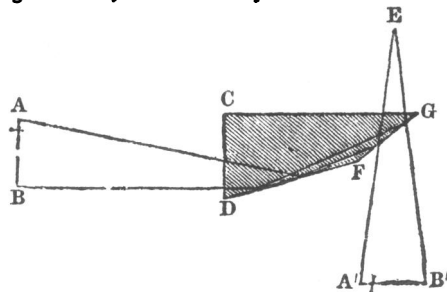
"Q. Can the magic lantern be applied to many useful purposes?"

"A. It can; as enlarging astronomical diagrams and representations in natural history, &c. If the lime-ball light be employed, the effect is then astonishing, as exhibiting not only the forms and motions of small animals, but even their internal structure to the circulation of the blood.

CAMERA LUCIDA.

"Q. How does the camera lucida act in the formation of pictures?"

"A. The camera lucida, one of the most elegant of optical instruments, consists of the following arrangement:—CDFG is a glass prism, having four sides inclined, as seen in the figure. The side CD being exposed to the object to be delineated, rays pass through it and fall upon the sloping side DF; from this they are reflected to the side



FG, and finally pass out of the prism to the eye at E. Now, from the direction in which rays enter the eye, it receives them as if coming from an image at A'B'. Accordingly, if a sheet of paper be placed below the instrument, a perfect delineation of the object will be formed upon it, which may be easily traced off with a pencil.

"The instrument is mounted on a convenient brass frame, which is so constructed as to allow the prism to approach to, or remove from, the paper, according to the size which the picture is required to have."